

TCS 005-4-2001



SPECIFICATION
FOR
TRIP INFORMATION SIGNS

Issued
November 2001
Amendment 1; January 2004



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PREFACE

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A. GENERAL

This specification has been developed by the VicRoads 'Traffic and Transport Integration Department' (herein called the "Department"). It is one of a number of technical specifications, and associated standard drawings, which set out the requirements for "on-road" ITS devices, traffic signal equipment and other electrical equipment and associated devices and control systems.

This specification, and associated standard drawings, is intended for use in all relevant works undertaken by or on behalf of VicRoads.

B. APPROVED PRODUCTS

All equipment covered by this specification shall hold current VicRoads 'Type Approval' certification. To obtain VicRoads 'Type Approval' the manufacturer/supplier must submit a written request, together with a sample product, to VicRoads for evaluation. Such requests shall include all relevant documentation demonstrating compliance with this specification

~~References to "approved" within this specification shall mean individual components or methods that have been previously accepted by the Department.~~


Type Approval issued in accordance with this specification does not constitute automatic approval against future versions of this specification. Where it is considered necessary, VicRoads may withdraw current Type Approval and request that the affected product be re-submitted for evaluation against future versions of this specification.

All equipment covered by this specification shall be manufactured by an approved manufacturer under a VicRoads approved Quality Assurance System and shall be subject to all requirements of audit therein.

CB1. ELECTROMAGNETIC COMPATIBILITY (EMC)

All equipment covered by this specification shall comply with all relevant requirements of the Australian Communications Authority (ACA) for EMC. Such equipment shall comply with the requirements of AS4251.1 Electromagnetic compatibility – Generic emission standard – Part 1: Residential, commercial and light industry.


For equipment complying with the ACA's 'Level 1' category a copy of a 'Declaration of Conformity' shall be supplied to VicRoads.

For equipment complying with the ACA's 'Levels 2 and 3' categories, a copy of a test report (from a NATA approved testing facility) showing compliance shall be supplied to VicRoads. Equipment falling into either of these two categories ([i.e. Level 2 and 3](#)) shall be labelled with a conforming 'C-Tick'. 

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DB2. TELECOMMUNICATIONS EQUIPMENT

All telecommunications equipment shall comply with relevant requirements of the [Australian Communications Authority \(ACA\)](#). Such equipment shall be labelled with an ACA issued

'A-Tick' .

Amendment History		
Amendments	Date Issued	Details
No. 1	January 2004	Revised Cover New Preface Requirements for Approval

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1.0 SCOPE AND GENERAL

This Specification covers the design, manufacture and installation of Trip Information Signs for use with the Drive Time System within the State of Victoria.

The Drive Time System provides real time, traffic density and travel time information on Melbourne's freeway network to road users through a number of electronic media. Trips Information Signs are one of a number of road-side information items through which the information is disseminated.

The successful tenderer (herein after called "the contractor") will be required to provide the signs, the sign housings and all peripheral mounting facilities together with the associated control and communications equipment to enable remote operation of the units from VicRoads.

The design, manufacture and installation (including commissioning) of all components of this project shall be undertaken in accordance with the requirements of the VicRoads Traffic and Road Use Management Department (herein after called "the Department").

1.1 GENERAL REQUIRMENTS

The signs are to be mounted behind the left shoulder of the freeway such that they are clearly visible from each lane of the carriageway of the approach to which each sign applies.

The signs shall be designed to provide legible, changeable, numeric information relating to travel time to nominated exits and colour coded indicators of congestion levels for sections between such nodes on the freeway.

The contractor shall be responsible for all resources necessary for the satisfactory acceptance and commissioning of the signs including but not limited to:

- i. design, manufacture and installation of the signs and associated control/communications equipment;
- ii. design, manufacture and installation of all supporting columns;
- iii. proof engineering of the designed structures;
- iv. all on-site civil and electrical works;
- v. commissioning of the signs and associated communication

VicRoads will provide:

- i. a 240 v (single phase, 15 amp, 50 Hz) mains supply; and
- ii. one (1) leased communications line;

1.2 RELATED SPECIFICATIONS AND DRAWINGS

The fabrication and supply of all components for Trip Information Signs shall conform with all relevant Australian Standards or, in the absence of same, with appropriate international standards.

All installation works shall conform to the relevant VicRoads specifications and related specifications and standards as indicated throughout this document.

The following related specifications and standard drawings are defined :

1.2.1 *Specifications, Standards and Documents*

- Manual of uniform traffic control devices, Part 2: Traffic control devices for general use AS 1742.2
- Degrees of protection provided by enclosures for electrical equipment (IP code) AS 1939
- SAA Wiring Rules AS 3000
- Electromagnetic Compatibility - Generic Emission Standard AS/NZS 4251
- Approval and test specification – Electric cables – Thermoplastic insulated for voltages up to and including 0.6 / 1 kV AS 3147.
- Approval and test specification–General requirements for electrical equipment AS 3100.
- Road Rules – Victoria
- VicRoads Specification - Installation and Remodel of Traffic Signals TCS 013-1-2000
- AS 1170 Traffic Signal Lanterns AS 2144
- Minimum Design Loads on Structures AS 3901
- Quality Management and Quality Assurance Standards AS 3900

1.3 QUALITY ASSURANCE REQUIREMENTS

The supply and installation of the required signs shall be undertaken within a Quality Assurance System acceptable to the Department. Such a system shall cover :

- identification and traceability of all major components to be provided including display modules, driver boards, power supplies, fibre-optic components, electrical equipment, cabinet housings, steel works and concrete;
- details relating to sign testing procedures and special processes;
- maintenance records and documentation;
- details of any non-compliance.

Invited tenderers are required to submit details of the proposed Q-A system to the Department at the time of tendering.

Notwithstanding the requirement to provide any other documentation requested within this specification, the contractor shall submit for consideration by VicRoads a project specific quality plan within two weeks of the acceptance of the tender.

The contractor shall incorporate into the Quality Plan a system element covering the management of occupational health and safety, with particular reference to the obligations under Section 21 of Part III of the Occupational Health and Safety Act 1985.

Third party accreditation to systems complying to AS 3900 (or similar) and/or acceptance of the contractors Q-A system for other VicRoads' projects or activities shall be taken as compliance to this requirement.

VicRoads may arrange surveillance and audits to ensure that the contractor is complying with its Quality System.

1.4 ON ROAD OPERATIONS

All on-road installation and commissioning functions associated with this project shall be undertaken by contractors currently registered with the Department to undertake On-Road Electrical works for VicRoads.

The contractor shall be responsible for the provision of all labour and facilities required for any lane closure and/or safety delineation works required during the execution of the contract.

1.5 ACCEPTANCE

The signs shall be formally accepted by the Department prior to installation, in accordance with clause 7.6. Such acceptance shall be acknowledged by the issue of a “Notification of Acceptance for Tender Purposes”.

All testing required for Acceptance shall be carried out by the manufacturer at the manufacturer’s expense.

2.0 SIGN REQUIREMENTS

The sign shall be constructed from marine grade aluminium (A5251 - H34) treated to ensure optimum performance under prolonged exposure to atmospheric and site conditions prevalent in the Melbourne and Metropolitan area. Materials used in manufacture shall be rated to withstand the effects of the aforementioned conditions for a period not less than ten (10) years.

2.1 SIGN CONSTRUCTION

The general construction requirements for the sign are such that :

- all metal surfaces of the sign (including all structural supports and/or bracing components) are suitably treated (galvanised, powder coated or plated) to ensure prolonged operation within the intended application;
- the colour of all exposed metal surfaces shall be black (or a colour approved by the Department) and shall be a matt finish;
- all surfaces of the signs shall be free from sharp edges or protrusions;
- deterioration due to atmospheric and/or local environmental conditions has no detrimental effect on the structural integrity or visual appearance (including colour fading) of the finished product for a period not less than ten (10) years;
- the finished product is suitably sealed to prevent the ingress of dust and moisture.

The completed sign shall incorporate :

- ready access from the rear of the sign to all integral display, control and communications components via hinged panels capable of being opened by a single operator and incorporating approved locks (eg. Southco) with VicRoads standard key for routine and/or fault maintenance purposes;
- rear safety access platforms suitably located to provide standing access to the integral components together with suitable fixed means of travel between the platforms. This requirement is intended to remove the need for a travel tower for each attendance to the sign. Such platforms shall not be accessible from ground level without the use of a ladder or steps or through an approved, locked access door;
- suitable venting and (if necessary) a fan forced air circulation system to ensure suitable conditions for ongoing operation of all integral display, control and communication components;

- an approved moisture inhibitor system.

3.0 DISPLAYS

The finished signs shall have display layouts similar to that shown in Figure 1. Individual elements of the display shall comply to the general requirements listed below.

3.1 DISPLAY FACE

The display face shall be constructed from high impact, anti-glare clear plastic sheeting of casting grade acrylic copolymer or polycarbonate.

The static “header” information on the display face shall be provided as white capital lettering (on black background) complying to the requirements of AS 1742, AS 1743 and AS 1744 and shall be to layouts approved by the Department.

The static “destination” information on the display face shall be provided as black lettering (on a white background) complying to the requirements of AS 1742, AS 1743 and AS 1744 and shall be to layouts approved by the Department.

The static display area shall be internally illuminated using fluorescent tubing of commonly available lengths suitably placed within the housing to provide uniform dimmable lighting, free from internal shadows for all static sections of the display. The lighting shall be activated by an integral light sensing device (Lumatrol ® or similar) and by command generated from the control system.

3.2 TRAVEL TIME NUMERIC INDICATION PANELS

The Travel Time displays shall be generated LED's (or other approved method) in a two digit numeric format which appears white, yellow or yellow/green in colour in the active state and matt black in the inactive state.

Each character shall have a nominal height of approximately 450. Each digit shall be centrally placed within the individual character matrix provided. Each numeral within a two digit array shall be separated by a spacing not less than twice the stroke width of the provided character.

The numeric display shall be visible through a clear, anti-glare window section within the display face and be centred within the module. The size of this section shall be designed such that the sides and bottom edges of the numeric display are fully visible at viewing angles of 45° and 30° respectively to the 0.0 axis of the sign face.

The pixel modules shall be capable of being removed and re-instated in-situ by hand and the construction and design of the cabinet, framework and

electronic driver networks should facilitate same. The pixel display system shall incorporate an appropriately designed dimming circuit.

3.3 COLOUR CODED CONGESTION INDICATION MAP

The Congestion Indication (strip map) section of the sign shall be generated by a suitably configured pixel array capable of generating five (5) over-laid displays:

- a. green to indicate light traffic conditions;
- b. yellow to indicate medium traffic conditions;
- c. red to indicate heavy traffic conditions;
- d. flashing red to indicate a "closed" section of the freeway; and
- e. blank (black) to indicate that the sign is "off" or that no information is currently available;

The strip map shall be generated to provide not less than two independent segments within each nominated section of the freeway (ie between each nominated node). Each section of strip map between adjacent nominated nodes shall be approximately 1000 mm in length. The width of the strip map shall be 200 mm, ± 20 mm.

An additional section of strip map, not less than 250 mm in length, and shaped to form an upward facing arrow shall be provided at the top of the strip above the final nominated destination. This section of the strip shall operate in conjunction with the upper most nominated section.

A similar length section shall be provided at the bottom of the strip map and operate in conjunction with the lower most nominated section.

All colours shall conform to chromaticity co-ordinates of red, yellow and green for Traffic Signals as defined in Table 2.1 of AS 2144 - 1989.

The materials used shall be such that all physical and optical characteristics of the product are unchanged by sustained exposure to Ultra Violet light emissions and temperatures in excess of 85⁰ Celsius.

The luminance and/or luminous intensity values for a dimmed display shall be variable in steps not less than 5% and not greater than 10% through the full range from 15% to 75%.

The resultant displays shall exhibit uniform light and colour distribution across the illuminated area. The uniformity of display intensity shall be such that the ratio of the average luminous intensity of the total display (I_{Total}) to the average luminous intensity of any portion (not less than 10%) of the display (I_{Sample}) is not less than 0.75 and not greater than 1.25.

i.e. $0.75 < I_{Total}/I_{Sample} > 1.25$

The design of the strip map shall ensure that the generated displays are:

- clearly visible during both night and day time operation in the approach range 500 m to 30 m prior to the sign from any lane of a standard four lane freeway;
- appear as distinct, even colour bars applicable to the adjacent section on the sign detailing nominated destinations.

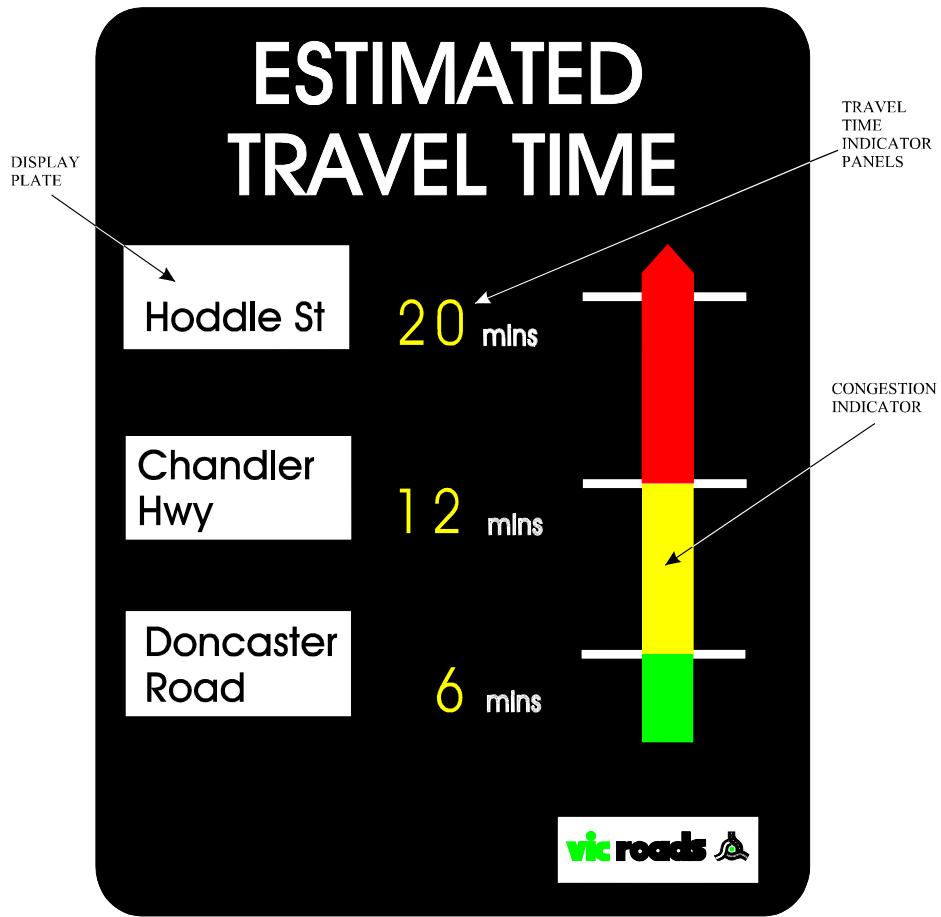
3.4 GENERIC SIGN DISPLAY TECHNOLOGIES

Where Light Emitting Diode (LED) technology shall used for external display purposes in the sign, the general operating and performance requirements for the LEDs and associated driver systems shall comply with Appendix B of this specification.

The LED equipment proposed for use in this project shall be of a brand and format acceptable to the Department. Full details and operational characteristics of the equipment to be provided for the numeric displays and strip maps must be submitted with the proposal. The Department reserves the right not to accept any or all technologies offered.

Where an alternative layout or technology is proposed for any element of the display, the tenderer shall provide details of the layout with the tender documents together with information relating to the viewing and legibility characteristics of the proposed technology.

HP Detailed drawings for all proposed display layouts and performance criteria for any of the proposed sign technologies shall be submitted for acceptance by VicRoads prior to production commencing. Where requested by the Superintendent or his representative, the contractor shall arrange for appropriate demonstrations of the display technologies to assure the Department of compliance to these requirements.



TYPICAL DISPLAY LAYOUT

Figure 1

4.0 CONTROL SYSTEM

The control system for the sign shall be capable of switching any of the required displays via remote operations communicating with VicRoads through a hard wire, leased communications line to the Corporation's computer system.

The remote operation shall also be capable of running a test procedure on the sign. The test procedure shall include the ability to initiate a continuous cycling operation of each individual display function and light settings.

In addition, the sign shall have the facility to locally switch the static display lighting, all numeric travel time displays and the colour coded strip map sections through any of the required settings for test and maintenance purposes from ground level at the sign. The operation of testing shall be through push buttons for each function and shall be housed in a termination box incorporating approved locks with VicRoads standard key.

4.1 COMMUNICATION PROTOCOL

Each sign will have multiple buffers, each buffer representing the segment and associated travel time information.

In the example below, sign #5" has four segments. To command the sign to display travel time of 3 minutes, 7 minutes, 12 minutes and 25 minutes with the respective colours of red, green, yellow and flashing red, the data commands would be as follows :

```
>xx05K0103rcc<cr>
>xx05K0207gcc<cr>
>xx05K0312ycc<cr>
>xx05K0425frcc<cr>
```

where	'>	is the start byte
	'xx'	is the unique packet identifier (2 character ascii encoded hex (00-ff))
	'05'	is the sign number (ascii encoded hex)
	'K'	is the command to control an output
	01, 02, 03, 04	is the segment number
	03, 07, 12, 25	is the travel time data
	r, g, y, fr	is the colour and operation of the associated map segments
	cc	is the checksum

4.1 MONITORING

The system shall be capable of monitoring the operation of the sign and generating a series of distinguishable status messages when interrogated from the remote location. Typical message information includes:

- a. the loss of communications with the sign
- b. the loss of mains power at the sign;
- c. the unique numeric digits being driven (or instructed to be driven) for each individual segment of the sign;
- d. the colour being switched for each individual segment of the sign;
- e. where fibre-optic components are used, the failure of the primary and/or secondary lamps within each individual lamp source for the fibre-optic strip map display;
- f. the status of the internal illumination and any failure of same.

4.2 FALL-BACK

The system shall incorporate the ability to automatically fall-back to a "blank" (blacked out) display where:

- i. mains power is lost at the sign; or
- ii. the communications to or from the sign are lost or adversely affected; or
- iii. a serious malfunction in the control or switching of any individual segment element which may lead to inappropriate or misleading displays being generated is detected.

5.0 ELECTRICAL REQUIREMENTS

In addition to complying to this specification, the sign and associated system shall comply to all relevant requirements of AS 3000, "Electrical Installation - Buildings Structures and Premises" (also known as the SAA Wiring Rules) and of AS 3100, "General Requirements for Electrical Equipment".

Transformers used within the sign and/or sign control system shall comply to AS 3108, "Approval & Test Specification - Particular Requirements for Isolating Transformers and Safety Isolating Transformers".

All cables and wires shall be insulated with a material not inferior to V-105 grade PVC.

The mains supply provided will be 240 v, 15 amp, 50 Hz ac and the system and or sub-elements of the system shall be capable of operating satisfactorily from same within $\pm 15\%$. The system shall be capable of being isolated from mains supply at ground level via a standard Traffic Signal controller facility key compatible switch.

The LED display modules, fibre-optic displays and associated driver units, monitoring and dimming networks and the control and communications equipment shall operate at extra low voltage (ELV).

All equipment shall be internally protected against damage resulting from:

- i. lightning strikes at or near the sign/gantry
- ii. electrical transients on power cabling
- iii. electrical transients on signal wiring
- iv. radio frequency interference
- v. static electrical discharge

The electrical system for the sign shall incorporate a variable flasher unit for the red "Heavy" display capable of varying both "on", "off" and "space" times of the light source from 0.5 seconds to 3.0 seconds in increments of 0.2 seconds.

NOTE: *The variable and fixed flash rates and cycle times shall ensure any light source may reach peak intensity and be fully extinguished during normal operation.*

5.2 EMC COMPLIANCE

The sign and all integral control and/or communication components shall comply with the requirements of AS/NZS 4251.

6.0 STRUCTURAL REQUIREMENTS

The signs are to be centrally mounted on suitably designed columns (2 off) and associated footings. A mower strip not less than 0.5 m larger than the base projection of the sign cabinet shall be installed (at ground level) around the base of the columns.

Details of the base plate to be used are provided in Figure 2.

The design of all structural steel work shall be carried out in accordance with the requirements of the AustRoads Bridge Code (1992) and Addendum, except where otherwise stated in the Specification.

All structural components of the project shall be designed for an operating life of 100 years, except where otherwise stated in the Specification.

Design of the structure shall be proof engineered by an independent engineering consultant and the details provided to the Department.

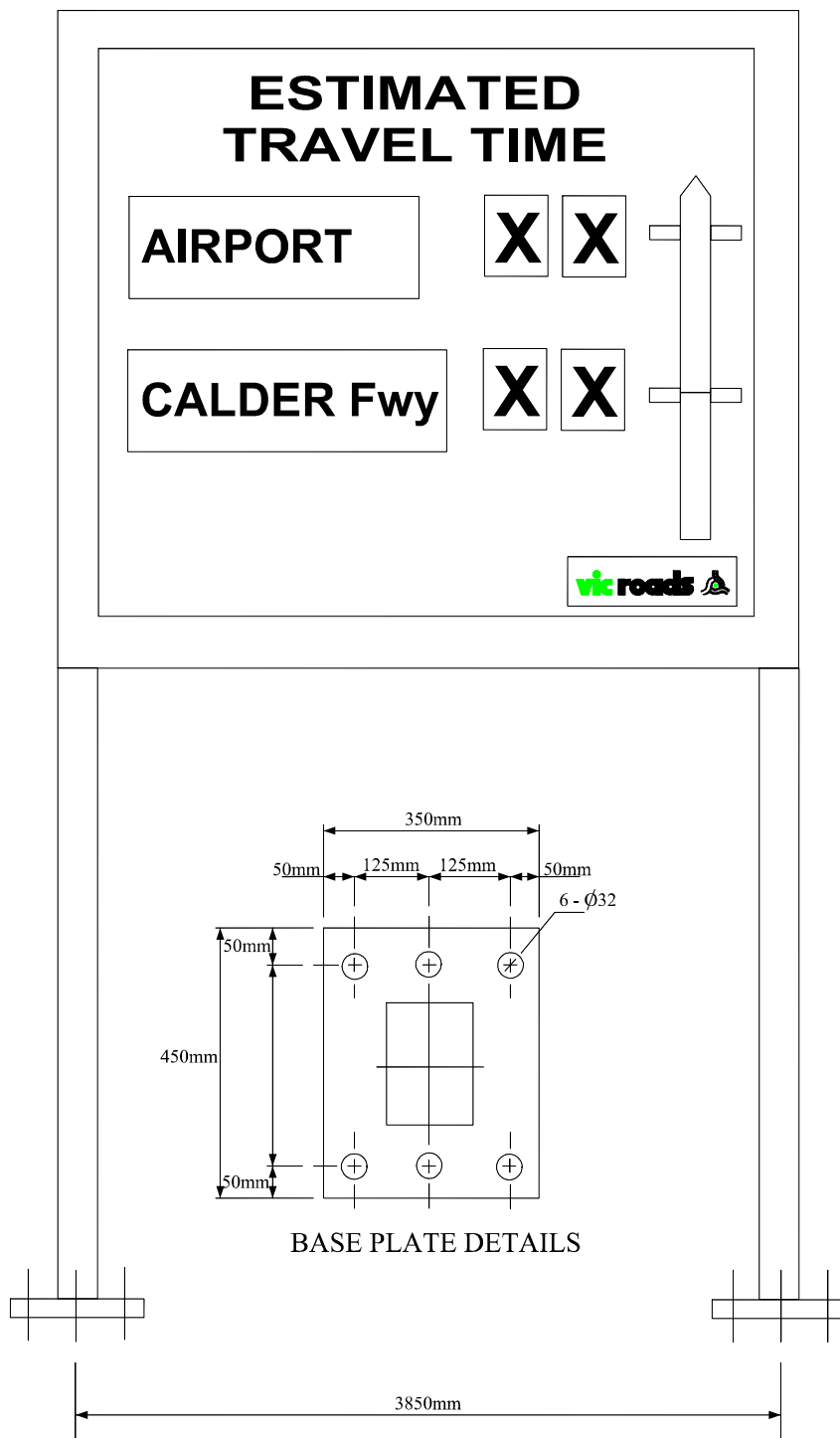


Figure 2

6.1 MOUNTING STRUCTURE

The mounting method shall ensure that the rear section of the housing and the face of the display modules are vertical. The sign shall be suitably aligned to point to the centre of the proposed carriageway at a distance of 250 metres from the face of the sign. Suitably designed struts or braces within the housing shall be used to ensure stability of the installed sign. Detailed plans of the footings, columns and associated fixtures shall be provided to the Department for review (for a period of seven (7) days) prior to manufacture of same.

Access for all power supply, control and communication cabling shall be through the centre of the column(s) and shall enter the sign housing through appropriately constructed, sealed entry points.

Except where otherwise approved, ground clearance shall be in accordance with the requirements of AS1742.2.

6.2 INSTALLATION

Unless otherwise defined, the contractor shall be responsible for the installation of :

- i. the base, supporting structure and access platforms together with any other mounting accessories;
- ii. the sign housing and all associated driver and control equipment;
- iii. any mounting, connecting and/or bracing structures;
- iv. the communication systems (including software and hardware);
- v. all cabling (including power and communications) from the "point of supply" to the equipment.

All installation works shall be conducted :

- a. in accordance with the general requirements of the Department and for site and personnel safety as defined in the VicRoads "Worksite Traffic Management (Roadworks signing) Code of Practice" document; and
and
- b. by contractors currently registered with the Department for the provision of On-Road Electrical activities.

Unless otherwise specified in individual tender documents, the contractor shall comply with the following requirements regarding time of work and lane closures:

- i. the contractor shall not use the emergency lanes between the hours of 7:00 am and 9:30 am on normal working days;
- ii. no lane closure shall be implemented between the hours of 6:00 am and 9:30 am and 4.00pm and 6.30pm on normal working days;
- iii. a minimum of two lanes for traffic use must be maintained at all times.

VicRoads reserves the right to vary the timing for the contractor to work on the site in the peak periods.

It shall be the contractor's obligation to comply to all relevant requirements of Federal, State and other government departments including the local energy authority, Gas and Fuel Corporation, local water authority, Telstra and local Government Municipalities in carrying out these works.

The contractor shall provide within the Contract Sum, the costs of:

- a. covering the display faces of the installed signs from the day of installation in the field until the unit is officially commissioned; and
- b. removing the covers on the day of commissioning.

6.3 COMMISSIONING

The contractor shall be responsible for the commissioning of the whole system including :

- a. full sign and light operation and associated control equipment;
- b. communications to the Department;
- c. access for local display switch for maintenance purposes;
- d. testing the integrity of the total sign and communications system.

7.0 MISCELLANEOUS

7.1 DEFECTS LIABILITY

Further to Clause No. 37 and No. 38 of the General Conditions of Contract, the signs (including the housing, control and communications equipment, all sign and communications software and peripheral items) supplied and/or installed by the contractor shall be subject to a warranty period against defects on all parts (including lamps and/or LED's used for lighting purposes) and labour of twelve (12) months from the date of commissioning.

Any item found to be defective during this warranty period shall be repaired or replaced (on-site) by the contractor within 24 hours of notification. All costs associated with the repair, replacement and transportation of such defective and/or replacement items shall be borne by the contractor.

7.2 MAINTENANCE

The contractor shall provide a proposed schedule for routine operational checks and preventative maintenance tasks to be performed on the sign and system equipment for the long term use of the sign by others.

7.3 SPARE COMPONENTS

The contractor shall provide a schedule of spare components recommended for retention for service and/or fault maintenance purposes and shall maintain a stock of such items until the expiration of the defects liability period.

VicRoads may elect to purchase all or part of the recommended maintenance stocks upon the completion of the defects liabilities period.

7.4 DOCUMENTATION

The contractor shall provide with the tender submission the following:

- a schematic of the exterior of the proposed sign showing estimated dimensions and total weight of the unit;
- information relating to the technologies proposed to be used in the display elements including optical/photometric and life performance details;
- an estimate of the total power consumption of the unit with and without internal back lighting illuminated;
- any other items relevant to the award of the contract.

Prior to the commencement of manufacturing works, the contractor shall provide (to the Department for review and retention) copies of:

- i. all structural drawings of the housing and proposed connection and/or bracing components and peripheral construction details, this shall include proof engineering of the designed structures/attachment brackets to ensure compliance with the specification;
- ii. wiring and cabling layouts and circuit diagrams;
- iii. manufacturer's specifications (catalogue extracts) of all major components detailing ratings and performance characteristics of same;
- iv. a schematic layout of sign components, building in details and interconnection diagrams;
- v. details of the modems and any specific communication standards proposed for the system;
- vi. details of the contractors project specific Quality Assurance plan;
- vii. a program of works.

Prior to the commencement of installation works, the contractor shall provide copies of:

- i. all component compliance details as required or implied under this document;
- ii. all test reports conducted by the contractor to ensure compliance to the specification;
- iii. recommendations for routine maintenance tasks on the sign and associated system;
- iv. recommendations on spare parts.

Prior to the commissioning of the sign and associated system, the contractor shall provide:

- i. a statement detailing the warranty provisions associated with the sign and associated systems;
- ii. one (1) bound copy of the final design drawings and "as built" installation details of the unit;
- iii. one (1) bound copy of the "Operation and Maintenance" manual for the sign, local control and remote control systems detailing the functionality of all components and suggested maintenance schedule.

7.5 TRAINING

The contractor shall provide training for up to five (5) VicRoads staff on the operation and maintenance of the sign and control system of not less than one (1) full day.

The costs of such training shall be incorporated within the lump sum price.

7.6 SIGN ACCEPTANCE

For the purpose of acceptance of the sign the contractor shall arrange :

- i. undertaking of a controlled seven (7) day continuous "burning in" test program designed to operated all mechanical and electrical/electronic aspects of the system including pixel, lights, monitoring and communications;
- ii. an inspection of the sign, sign housing and control equipment (including remote communications equipment) at an agreed location;
- iii. submission of all required documentation and relevant details of compliance of the sign and system as specified;
- iv. a demonstration of the operation and monitoring facilities of the sign (including remote operation).

The acceptance of the sign shall be subject to satisfactory compliance by the contractor to each of the above items and the submission of verified test reports relating to same.

7.7 PRACTICAL COMPLETION

Prior to commissioning, the contractor shall arrange for :

- i. an on-site inspection of the "as installed" sign and control equipment (including all cabling and interconnections);
- ii. submission of all required documentation and "as built" details of structural connections for the sign as required within this document;
- iii. a pre-commissioning demonstration of the programming, operation and monitoring facilities of the sign for both local and remote operation.

Upon satisfactory acceptance of the structural design and pre-commissioning demonstration, VicRoads will nominate a date for the contractor to commission the sign.

Upon satisfactory inter-facing of the sign control system to the VicRoads computer system the Department will issue a "Certificate of Practical Completion".

APPENDIX**LIGHT EMITTING DIODES**

Any Light Emitting Diodes (LEDs) used to create the displays for this sign shall meet the following general requirements:

1.0 PHOTOMETRIC REQUIREMENTS**1.1 LUMINANCE RATIO**

The Luminance Ratio levels are set so that the presence of external sources of light will not cause a lowering of the contrast of the display such that it becomes ineffective. If the sign has a variable luminance setting, then the Luminance Ratio requirement should be met first and then the minimum levels of luminance must be met at that luminance level or greater. The test procedures for the measurement of Luminance Ratio are given in Attachment 1.

Luminance Ratio Requirements:

Sign Illuminance (lux)	Minimum Luminance Ratio (LR)	
	White or Yellow Legend	Red or Green Legend
40,000	10	5
4000	10	5
400	10	5
40	-	-
<4	-	-

1.2 LUMINANCE

The signs are to be used 24 hours a day in which case automatic dimming will be required as the levels of luminance necessary to be effective during the day will cause far too much glare to the driver at night. There are three levels of luminance specified, one for use in the daytime, one for use at night in well lit urban areas and one for use in unlit areas. The test procedures for the measurement of Luminance are given in Attachment 1.

Luminance Requirements

Ambient Lighting Condition	White or Yellow Legend		Red or Green Legend	
	Min. Luminance (cd/m ²)	Max Luminance (cd/m ²)	Min. Luminance (cd/m ²)	Max Luminance (cd/m ²)
Daytime	6000	60,000	2500	25,000
Night-time/ Urban/ Lighting	300	3000	150	1500
Night-time/ No Lighting	50	300	30	300

For self-luminous elements, the luminance shall be measured with no external illumination. For non-self-luminous signs the daytime luminance is measured with an external illumination of 40,000 lux.

1.3 LUMINANCE OR LUMINOUS INTENSITY UNIFORMITY:

The luminance or luminous intensity uniformity shall be met for each colour and each intensity setting. For reflective elements, the luminance or luminous intensity uniformity shall be met for daytime and night time conditions.

The luminance or luminous intensity of any two elements shall not vary by more than the ratio of 5:1.

The ratio of the average of the highest three elements outputs to the average of the lowest three elements outputs shall not vary by more than 2.5:1.

The test procedures for the measurement of luminance or luminous intensity are given in Attachment 1.

1.4 VIEWING ANGLE:

There are two separate requirements for viewing angle. The measurement criteria for viewing angle is the minimum Luminance Ratio (LR).

The Luminance Ratio requirements as set out in the Table below are to be achieved at $\pm 10^\circ$ horizontal and $\pm 2.5^\circ$ vertical.

Viewing Angle - Luminance Ratio Requirements.

Sign Illuminance (lux)	Minimum Luminance Ratio (LR)	
	White or Yellow Legend	Red or Green Legend
40,000	5	3
<4	5	3

2.0 COLOURS:

When tested in accordance with Attachment 2, the light emitted by each colour present in the message must comply with the chromaticity coordinates in the Table below and illustrated in Figure 3.

Chromaticity Coordinates

Colour		1	2	3	4
Red	x	0.690	0.710	0.680	0.660
	y	0.290	0.290	0.320	0.320
Yellow	x	0.536	0.545	0.592	0.583
	y	0.445	0.454	0.407	0.398
Restricted Yellow *	x	0.535	0.545	0.566	0.575
	y	0.445	0.454	0.415	0.424
Green	x	0.009	0.284	0.207	0.012
	y	0.720	0.520	0.397	0.494
Blue	x	0.090	0.186	0.233	0.148
	y	0.137	0.214	0.167	0.025
White	x	0.440	0.285	0.285	0.440
	y	0.382	0.264	0.332	0.432

*Restricted Yellow colour will be used whenever Red and Yellow are used together.

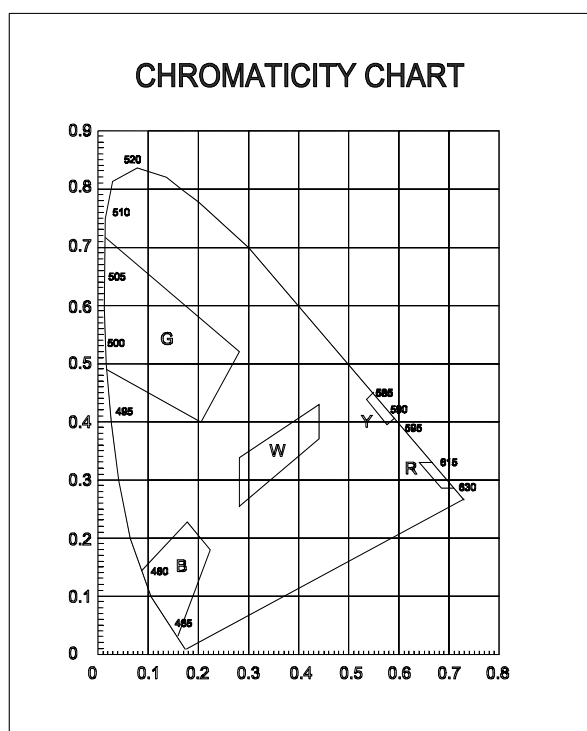


Figure 3

3.0 LIFETIME PERFORMANCE TESTING:

The purpose of this test is to ensure that the degradation of the unit is within acceptable limits. The test is designed to measure the deterioration in performance of the optical properties of the active elements as well as the deterioration in the optical properties of any transparent protective cover.

3.1 REQUIREMENTS

The requirements are that:

- (i) after 12 months operation in the field, the sign shall demonstrate an optical performance as described in this document that is no less than 95% of the values determined at its initial compliance testing, and
- (ii) after 36 months operation in the field, the sign shall demonstrate an optical performance as described in this document that is no less than 85% of the values determined at its initial compliance testing.

3.2 SAMPLE PREPARATION

The sample provided at the time of the initial compliance testing will be taken and located outdoors in the same position as its intended use in the field. This will then be left to weather for 12 months. The intention is that the transparent protective cover be exposed to similar weathering conditions as

the initially compliant sign placed in the field. Consequently, it is not necessary that the discrete element module, initially provided in the casing, remains in the casing for the weathering exposure periods.

After the initially compliant sign has been operating in the field for 12 months, a module is selected from the sign face and removed. This module is then placed in the weathered casing and the tests carried out as described in this document. The casing is then placed outdoors again to continue weathering for a further 24 months i.e a total of 36 months.

After the initially compliant sign has been operating in the field for 36 months, a module is selected from the sign face and removed (not the module that replaced the one that was removed at the 12 months period). This module is then placed in the casing which has now been weathered also for 36 months and the tests carried out as described in this document.

ATTACHMENT 1 - PHOTOMETRIC TEST PROCEDURES

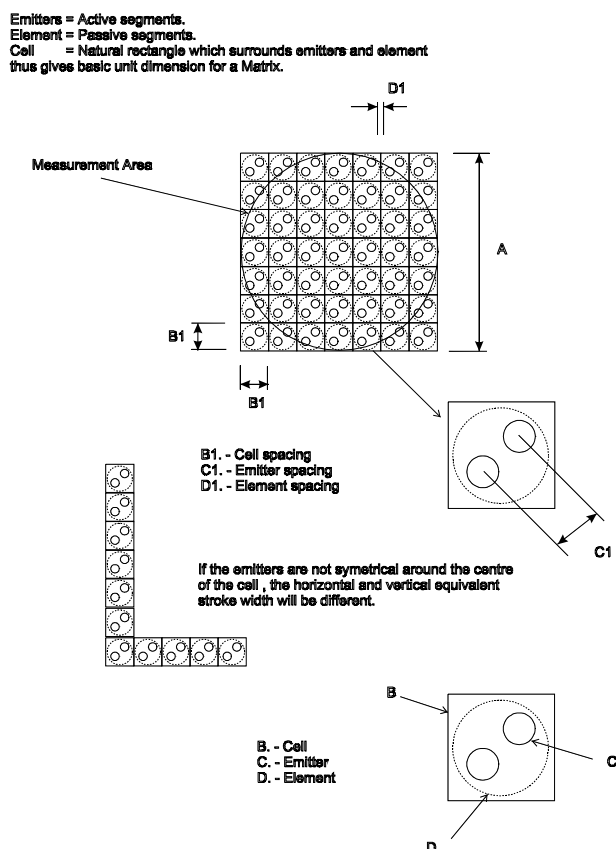
A1. TEST PROCEDURES FOR LUMINANCE RATIO MEASUREMENT.

The configuration of the sign, the solar source and the luminance meter for measurement purposes and all associated test procedures shall be agreed by the Department.

The sign's illuminance over the test area shall be measured and shall be 40,000, 4000, 40 and <4 lux. The illuminance shall be uniform over the test area, the measurements of illuminance shall be within $\pm 10\%$ of the nominal values. The test area must be at least 100mm in diameter or consist of a minimum of a 5x5 matrix of elements whichever is the greater.

Measurements of luminance shall be taken with the sign in the following states:

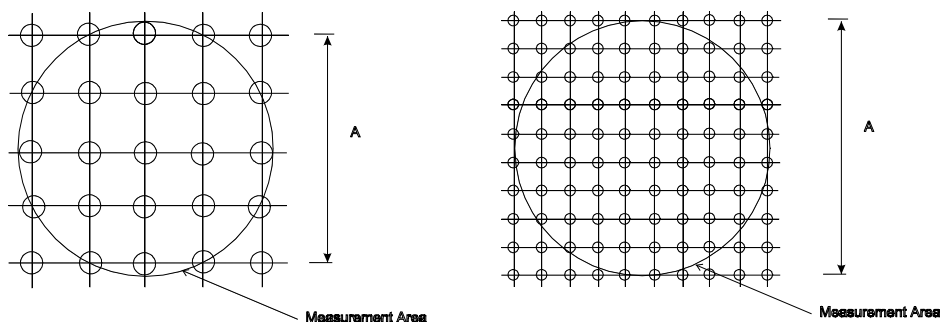
- (i) with all elements of the test area active (L_a)
- (ii) with all areas of the test area inactive (L_b).



A2. TEST PROCEDURES FOR LUMINANCE MEASUREMENTS

The luminance of the sign after any adjustment to comply with the Luminance Ratio requirements is simply $(L_a - L_b)$. This is the case for self-luminous signs, reflective signs and hybrid signs. Thus the daytime luminance requirement is to be measured with an external illuminance of 40,000lux, and the two night time luminance's are to be measured with no external illuminance. It is also possible to measure the luminance of the sign that has only self-luminous elements without any external source.

The test area for luminance measurements must be at least 100mm in diameter or consist of a minimum of a 5x5 matrix of elements whichever is the greater.



A3. VIEWING ANGLE

The viewing angle performance of the test module is to check the ability of the sign to be read from any point across a road and if the sign is cantilevered over the road. The viewing angle performance shall be determined using a series of Luminance Ratio tests. The test procedure is the same as for the Luminance Ratio test but with the luminance meter moved to the required angles or the sign module mounted on a goniometer.

Within the field of measurement the luminance pattern shall be substantially uniform.

A4. LUMINOUS INTENSITY UNIFORMITY.

Luminance or luminous intensity uniformity tests are required to ensure all the active elements can be clearly seen from any point from any point across a road or when cantilevered over the road. Misalignment of the elements could cause loss of legibility when viewed from different positions.

The luminance or luminous intensity of individual elements shall be measured on the geometric axis and at the combined positions as detailed below without external illuminance from the solar source.

Combined uniformity test points for each element

Horizontal angle (°)	Vertical angle (°)
-7	-2
+7	-2
0	0

The measurements of luminous intensity must be carried out at a sufficient distance from the source element that the inverse square law applies. Measurements of luminance of each source element must ensure that the element is central and completely inscribed within the measurement aperture.

A minimum of 25 adjacent individual elements shall be measured.

The following formula shall be applied to the three highest and three lowest measurements of each of the three sets of measurements:

$$\frac{\text{Average of the highest three elements}}{\text{Average of the lowest three elements}}$$

For each of the three sets of readings, this ratio shall not vary by more than that given in paragraph 1.3 of Appendix B.

For each of the three sets of readings, the output of any two individual elements shall not vary by more than that given in paragraph 1.3 of the Appendix.

ATTACHMENT 2 - COLORIMETRIC TEST PROCEDURES

The measurement of colour required by this specification may be made by any method which gives results of the required standard of accuracy, that is ± 0.003 in the CIE 1931 chromaticity coordinates at the 95% confidence limit.

The spectral distribution of LEDs is quasi-monochromatic and so the measurement of the colour of LEDs is more sensitive to errors of mismatch between the spectral response of the photometer and the $V(\lambda)$ curve. Consequently, it is recommended in the CIE (1997) document that the photometer response should have a spectral response with

$$f_1' < 1.5\%$$

Colour measurements shall be in terms of the chromaticity measurements of the CIE 1931 Standard colorimetric system.

The requirement that the measured chromaticity coordinates lie within the specified regions of the colour diagram is to aid identification by road users that have a colour deficiency.

Care should be taken that only the colour of the emitted light is measured and that adequate precautions are taken to eliminate stray light.

The colour measurement should be taken over the test area with all the elements within that area active.

The test module should be operated according to the conditions specified by the manufacturer at the daytime luminance and at the fully dimmed luminance.

The colour shall be measured along the geometric axis and at the angles specified in Section A4 of Attachment 1.

APPENDIX

REQUIREMENTS FOR TYPE APPROVAL OF A TRIP INFORMATION SIGN

A1. GENERAL

To enable assessment for the purpose of granting Type Approval, the supplier is to submit a formal request for Type Approval accompanied by the following:

- a. A complete working sample of the Trip Information Sign.
- b. An outline drawing showing the general presentation and overall dimensions of the complete trip Information Sign
- c. Documentation to demonstrate that the trip Information Sign has been manufactured and supplied under an approved quality assurance system.
- d. Documentation to demonstrate that the trip Information Sign conforms to the requirements of VicRoads Specification. This may be by means of submitting test results from approved and appropriately qualified independent testing organisations, or providing the manufacturer's assurance that the product complies with each paragraph of the specification.

A2. REQUIRED NATA ACCREDITED TESTING

Notwithstanding A1 above, the supplier shall submit test results from a NATA accredited testing organisation to demonstrate compliance with the following:

Clause 5.2	EMC Compliance
Clause 3.4 & Appendix	Colourmetric and Photometric Requirements

A3. OTHER REQUIRED TESTING

- a. VicRoads may require additional information or testing to be carried out as part of its evaluation of the product.
- b. If the product is approved, a Certificate of Type Approval will be provided to the supplier. Until such time as this Certificate is issued, the product is not to be used in the State of Victoria.

A4. ASSESSMENT PROCEDURE

The assessment procedure for a Trip Information Sign will include, but not be limited to, the following:

- a. Assessment of construction, workmanship and critical dimensions.
- b. Evaluation of the submitted data against the requirements of the specification

Where some of these procedures have been completed prior to formal submission, the results will be considered in the evaluation, provided there is no relevant change in the design. The supplier is to state whether tests carried out prior to formal submission were carried out on an identical sample.